NOPR Public Meeting
Test Procedures for High-Intensity Discharge Lamps

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Thursday, January 19, 2012

Welcome

- Introductions (including web participants)
- Role of the Facilitator
- Ground Rules (norms)
  - Listen as an ally
  - Use short, succinct statements/keep to the point
  - Hold sidebar conversations outside the room
  - One person speak at a time (raise hand to be recognized; state your name for the record; web participants will have certain times allotted for their Q&A)
  - Set cell phones (and other devices that make noise) to silent/vibrate, web participants mute phones.
- Housekeeping Items
- Agenda Review
- Opening Remarks

Public Meeting Agenda

9:00 – 9:30 am	Welcome, Introductions, Opening Statements
9:30 – 9:45 am	Statute and Context
9:45 – 11:15 am	Proposed Test Procedures: Definitions; Test Methods
11:15 – 11:30 am	Break
11:30 – 12:00 pm	Proposed Test Procedures: Laboratory Accreditation Program; Test Measurements and Calculations
12:00 – 12:30 pm	Conclusion and Closing Remarks
12:30 pm	Adjourn

At the end of each section, time will be set aside for Web participants to ask questions and/or make statements.

Questions e-mailed during webinar will be included in the transcript.

Purpose of the Test Procedures NOPR Public Meeting

1. Review statute and DOE actions for high-intensity discharge (HID) lamps.

2. Present DOE's proposed test procedures

3. Seek comment from participants on the proposed test procedures

At this time DOE welcomes opening remarks (including from Web participants) on the NOPR for the HID Lamp Test Procedures.

Issues for Comment

Issue Box: DOE welcomes comment concerning the proposed HID lamp test procedures. Throughout this presentation, issues will be raised for discussion on slides in boxes like this, with identifying numbers corresponding to those in the HID Lamp Test Procedures NOPR.

Issue box numbering corresponds to the list of issues published at the end of the Test Procedures NOPR published December 15, 2011:

http://www1.eere.energy.gov/buildings/appliance_standards/pdfs/hid_tp_nopr_fr_notice_2011_12_15.pdf

Comment Period Ends: Tuesday, February 28, 2012

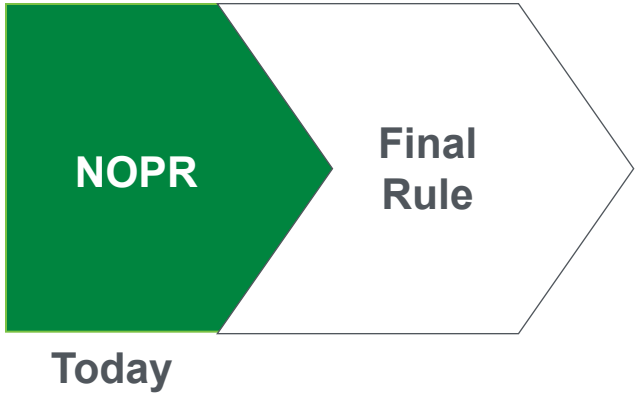
Public Meeting Agenda

1. Statute and Context
2. Proposed HID Lamp Test Procedures
3. Closing Remarks

Regulatory History – Test Procedure

Energy Policy and Conservation Act (EPCA), 1975	Established energy conservation standards and methods of test procedure development for consumer products.
HID Notice of Determination 75 FR 37975 (July 1, 2010)	DOE issued a final determination that standards and test procedures are technically feasible, economically justified, and result in energy savings.
Current test procedures rulemaking 76 FR 77914 (Dec. 15, 2011)	DOE proposed test procedures for HID lamps based on a review of industry standards and a review of technical aspects of the technology and measurement.

Test Procedures Rulemaking Process/ Schedule



Milestone	Date
HID Test Procedures NOPR Issued, 76 FR 77914 Beginning of 75 day comment period	*December 15, 2011*
End of 75 day Comment Period	*February 28, 2012*
Final rule to establish any final test procedures for HID lamps (projected)	*January 1, 2013*

CIE* Standards

Standard	Subject
CIE 13.3 - 1995	Method of Measuring and Specifying Color Rendering of Light Sources
CIE 15 - 2004	Colorimetry

- **These CIE standards are proposed to be incorporated by reference into 10 CFR part 431**

***International Commission on Illumination (Commission Internationale de l'Eclairage (CIE))**

ANSI* Standards

Outdated Reference Standards	Updated or Current Standard	Subject
ANSI C78.386 -1989 (Mercury Lamps)	**ANSI C78.389-R2009**	-for Electric Lamps -High-Intensity Discharge -Methods of Measuring Characteristics
ANSI C78.387 - 1990 (Metal Halide Lamps)		
ANSI C78.388 - 1989 (High Pressure Sodium Lamps)		
NA	**ANSI C78.379-2006**	-for Electric Lamps -Classification of the Beam Patterns of Reflector Lamps

- **ANSI standards are proposed to be incorporated into 10 CFR part 431**

* American National Standards Institute

IES* Standards

Current Standard	Subject
LM-47-01	Approved Method for Life Testing of High Intensity Discharge (HID) Lamps (for testing of lumen maintenance)
LM-51-00	Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps

- **LM-47 and 51 are proposed to be incorporated by reference into 10 CFR part 431**

* Illuminating Engineering Society of North America (IES formerly abbreviated as IESNA)

No Measure of Standby Mode and Off Mode Energy Usage

- HID lamps are considered to be commercial equipment.
- HID lamps do not operate in either standby or off mode.
- Therefore no measure of standby and/or off mode energy use for HID lamps is included in this NOPR.

Public Meeting Agenda

1. Statute and Context
2. Proposed HID Lamp Test Procedures
3. Closing Remarks

Proposed HID Lamp Test Procedures

- Definitions
- Test Methods for Measuring Energy Efficiency of HID Lamps
- Laboratory Accreditation Program
- Test Measurements and Calculations

Existing Definitions – No Amendment

- The following definitions from EPCA are relevant to the HID lamp test procedures.

- DOE proposes to adopt **without modification** these definitions:

"ballast"	"color rendering index"
"correlated color temperature"	"high-intensity discharge lamp"
"mercury vapor lamp"	"metal halide lamp"

Ref: 42 U.S.C. 6291 (58), (30)(J), (30)(K), (46), (47)(A), and (63)

Existing Definitions – Requiring Amendment

- The following definitions from 10 CFR part 430 are relevant to the HID lamp test procedures.

- DOE proposes to adopt with **minor modifications** these definitions:

"lamp electrical power input"	"lamp wattage"
"lumen maintenance"	"rated luminous flux or rated lumen output"

Ref: 10 CFR 430.2, subpart R, 42 U.S.C (30)(O), 10 CFR 430.2, Subpart B, appendix W, sections (2)(c) and (2)(d).

New Definitions for HID Lamps

- Additional definitions are necessary for the HID lamps test procedures in order to provide a comprehensive test procedure that produces consistent and reproducible test measurement results.

- DOE proposes that the following new definitions are needed for the HID test procedures:

"beam angle"	"directional lamp"
"high-pressure sodium lamp"	"lamp efficacy"
"self-ballasted lamp"	"basic model"

New Definitions for HID Lamps (directional lamp, beam angle)

- DOE proposes to distinguish **directional lamps** by distribution rather than lamp construction.
- DOE's proposed definition of **directional lamp** is based on the current European Union definition (Commission Regulation (EC) No 244/2009).
- The proposed definition for "directional lamp" is:

  'Directional lamp' means a lamp emitting at least 80 percent light output within a solid angle of π steradians (corresponding to a cone with an angle of 120 degrees).
- DOE proposes to use the industry-accepted practice for **beam angle** measurement as specified in ANSI C78.379
- The proposed definition for "beam angle" is:

  'Beam angle' means the beam angle (or angles) as measured according to the requirements of ANSI C78.379, including complex beam angles as described in ANSI C78.379, appendix A.

New Definitions for HID Lamps (high-pressure sodium lamps)

- DOE is proposing a definition for **high-pressure sodium lamp** (HPS)
  - recommended by NEMA in response to the HID lamps notice of proposed determination (75 FR 22031) and
  - based on the one given for "HPS lamps" in ANSI C82.9-1996, "American National Standard for High-Intensity Discharge and Low-Pressure Sodium Lamps, Ballasts and Transformers – Definitions (ANSI C82.9)."

- The proposed definition for "high-pressure sodium lamp" is:

'High-pressure sodium lamp' means a high-intensity discharge lamp in which the major portion of the light is produced by radiation from sodium vapor operating at a partial pressure of about 6,670 pascals (approximately 0.066 atmospheres or 50 torr) or greater.

New Definitions for HID Lamps (lamp efficacy)

- For the proposed rule DOE proposes to adopt and amend the existing definition for **lamp efficacy** from 10 CFR 430 Subpart B, Appendix R by:
  - replacing “lamp lumen output” with “rated luminous flux or rated lumen output” and
  - adding the abbreviation “lm/W” after “lumens per watt.”

- The proposed modified definition for “lamp efficacy” is:

  ‘Lamp efficacy’ means the ratio of rated lumen output (or rated luminous flux) to the measured lamp electrical power input in watts, rounded to the nearest tenth, in units of lumens per watt (lm/W).”

New Definitions for HID Lamps (self-ballasted lamp)

- DOE proposes test procedures for **self-ballasted** HID **lamps** (those that require no external ballast).

- DOE proposes a definition for **self-ballasted lamps** based on that used for self-ballasted CFL lamps. (10 CFR part 430, subpart B, Appendix W)

- The proposed definition for a "self-ballasted lamp" for HID lamps is:

  'Self-ballasted lamp' means a lamp unit that incorporates, all elements that are necessary for the starting and stable operation of the lamp in a permanent enclosure, and does not include any replaceable or interchangeable parts."

New Definitions for HID Lamps (basic model)

- To demonstrate compliance with an efficacy standard for HID lamps, manufacturers must test each "basic model" (10 CFR 429.11)
- The proposed definition for a HID lamp "basic model" is:

> *'Basic model' with respect to HID lamps means all units of a given type of covered equipment (or class thereof) manufactured by one manufacturer, having the same primary energy source and which have essentially identical electrical, physical, and functional (or hydraulic) characteristics that affect energy consumption, energy efficiency, water consumption, or water efficiency, and are rated to operate a given lamp type and wattage."*

Issue 1a: DOE invites comment on the proposed new definitions.

Existing Definitions Requiring Amendment

- DOE proposes to amend the existing definition for "ballast efficiency" to distinguish the values "P_{in}", "P_{out}" and "lamp electrical power input"

- The proposed modified definitions for "ballast efficiency" is follows:

  'Ballast efficiency' means, in the case of a high-intensity discharge fixture, the efficiency of a lamp and ballast combination, expressed as a percentage, and calculated in accordance with the following formula:

  Efficiency = Lamp electrical power input / Ballast power input

Issue 1b: DOE invites comment on the proposed amendments to existing definitions and whether alternative amendments would be more appropriate for HID lamp testing.

Proposed HID Lamp Test Procedure

- Definitions
- **Test Methods for Measuring Energy Efficiency of HID Lamps**
- Laboratory Accreditation Program
- Test Measurements and Calculations

Test Method for HID Lamps (proposed test conditions)

- Proposed Test Conditions (ANSI C78.389):
  - Ambient temperature 25 °C ± 5 °C
  - Air speed ≤ 0.5 meters per second (m/s)

Issue 2: DOE requests comment on the proposed ambient test temperature requirements.

Issue 3: DOE requests comment on the proposal to adopt for HID lamps the same air speed requirements as DOE required for the MH Lamp Ballast Test Procedure (2010).

Test Method for HID Lamps (electric and photometric measurements)

- To determine HID lamp efficacy and color parameters, the proposed test procedures requires measurement of the photometric and electrical characteristics of the lamps

Electric	Photometric
line voltage	total luminous flux (lumens (lm))
lamp voltage	luminous intensity (candelas (cd))
lamp current	correlated color temperature (CCT)
power input	color rendering index (CRI)

- Proposed measurement details are derived from ANSI C78.389 and LM-51

Test Method for HID Lamps (power supply characteristics)

- DOE proposes power supply characteristics requirements for these HID lamps test procedures that are derived from ANSI C78.389 and LM-51:
  - Voltage supply waveshape must be sinusoidal
  - Root-mean-square (rms) sum of harmonic components must be less than 3% of the fundamental frequency
  - Voltage regulation within ± 0.1% (from LM-51)
  - Power source impedance must be less than or equal 2% of the reference ballast impedance
  - Kilovolt-amperes rating of variable autotransformers or other voltage transformation devices should be at least five times the test lamp's normal wattage

Issue 4: DOE invites comments on the proposal to adopt the waveshape, voltage regulation, and power source impedance requirements of ANSI C78.389 in part and LM-51.

Test Method for HID Lamps (reference ballast requirements)

- DOE proposes that lamps are to be operated with an appropriately rated **reference ballast**
  - Provide specified power, voltage and current (ANSI C78.389. sec 3.4.)
  - Readily available
  - Other ballasts may provide results that are not consistent, only valid for specific ballast and circuit

Issue 5: DOE invites comments on the proposed reference ballast requirements and the appropriateness of adopting the requirements as recommended by ANSI C78.389.

Test Method for HID Lamps (instrumentation requirements)

- Proposed HID test procedures adopt the **instrumentation requirements** of ANSI C78.389 for electrical measurements and LM-51 for photometry
- For electrical measurements these are:
  - Better than 0.75% accuracy in the frequency range of 40 to 1000 Hz.
  - Voltage drop and current draw caused by impedance must be within specified limits for each lamp type
- For light output and color measurement these are:
  - Photometer with an approximate V-lambda (V(λ)) spectral response
  - Integrating sphere used for total luminous flux measurements

Issue 6: DOE invites comments on the proposed instrumentation specifications and the appropriateness of adopting these requirements from ANSI C78.389, section 3.8, and LM-51, section 9.0.

Test Method for HID Lamps (sampling method)

- Proposed **sampling method** to be adopted from the GSFL/GSIL/IRL sampling plan - 10 CFR 429.27
  - Sample of 21 units over a 12-month production period.
  - Use true mean lamp characteristics values for sample group measurement data (e.g., lumen output, lumens per watt, CCT and CRI)
- For each basic model of HID lamps:
  - Measurement results for all samples averaged over 12-month period
  - Each lamp characteristic sample mean derated and confidence limit set to 95%
  - Each lamp characteristic mean value no greater than the lower of the mean of the sample or the lower 95% confidence limit divided by 0.97

Issue 7: DOE invites comments and data on the precision and applicability of the proposed sampling method.

Test Method for HID Lamps (aging and stabilization)

- Prior to testing, DOE proposes that all lamps be **"aged" 100 hours** in the burning position that would be used during testing (ANSI C78.389)

- DOE proposes that all lamps be warmed up sufficiently and checked for **stabilized** operation prior to measurement to obtain reproducible and consistent measurements. (ANSI C78.389)

Table III.1 ANSI C78.389 HID Lamp Warm-Up and Stabilization Criteria

Lamp Type	Lamp Warm-Up Time	Stabilization Criteria
MV	15–20 mins	3 successive measurements (voltage and current) 5 minute measurement intervals Change in value < 1.0%
HPS	1 hour	3 successive measurements (voltage and current) 10-15 minute measurement intervals Change in value < 1.0%
MH	6 hours operated within ±10% rated wattage	3 successive measurements (voltage and current) 10-15 minute measurement intervals Change in value < 3.0%

Issue 8: DOE invites comments and data on the applicability of the proposed 100-hour aging requirement and stabilization methods.

Test Method for HID Lamps (cool down and re-stabilization)

- DOE proposes HID lamp **transfer** and **re-stabilization** requirements that vary by lamp type
  - MV lamps do not require prior cooling prior to transfer
  - MH lamp orientation must not change else longer re-stabilization times will be required
  - HPS lamps must be cooled and will require 1 hour warm up time

- DOE proposes detailed lamp stabilization, **re-stabilization** and lamp **transfer** requirements for the various HID lamp types, as described in ANSI C78.389

Issue 9: DOE has proposed lamp cool down and re-stabilization methods for HID lamps and invites comments on whether an alternative re-stabilization method should be considered.

Test Method for HID Lamps (lamp orientation)

- DOE proposes the **lamp orientation** requirements in ANSI C78.389
- **Orientation** is critical for aging, stabilization, and testing of HID lamps
  - DOE proposes lamps marked “universal” or that lack a specified position be operated in the **base up position**
  - DOE proposes lamps for use in a specified operating position be tested in that **specified position**

Issue 10: DOE invites comments on the appropriateness of the lamp orientation requirements in section 3.6 of ANSI C78.389 that require base up unless otherwise specified.

DOE also seeks comments on whether a preferred lamp orientation exists for lamp testing.

Test Method for HID Lamps (directional lamps)

- DOE proposes that HID lamp test procedures for **directional lamps** with a discernible beam pattern include determination of the **beam angle**
- **Beam angle** is **calculated** using the results of goniophotometric testing
- DOE proposes **set-up** and **measurement** of **directional lamps** be done following ANSI C78.379

Issue 11: DOE invites comments on the proposed setup and measurement standard selection for directional lamps based on ANSI C78.379.

DOE also invites comments on the various methods for calculating beam angle.

Proposed HID Lamp Test Procedure

- Definitions
- Test Methods for Measuring Energy Efficiency of HID Lamps
- **Laboratory Accreditation Program**
- Test Measurements and Calculations

Laboratory Accreditation Program

- DOE proposes that testing be conducted by independent test laboratories that are also **accredited** by the **National Voluntary Laboratory Accreditation Program (NVLAP)** or by an accrediting organization recognized by **NVLAP**

- DOE proposes that a manufacturer's or importer's own laboratory, if accredited by NVLAP or by an accrediting organization recognized by NVLAP, may conduct the applicable testing

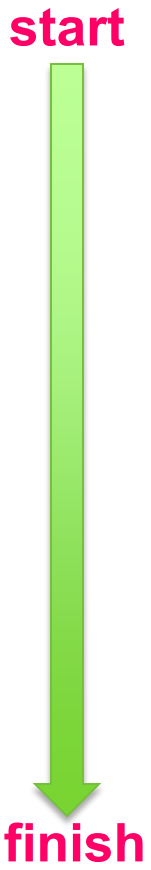
Issue 12: DOE requests comment on the proposal to require NVLAP-accredited (or equivalent) laboratories for testing similar to as DOE required in the GSFL/IRL/GSIL test procedure (issued Dec 2011).

Proposed HID Lamp Test Procedure

- Definitions
- Test Methods for Measuring Energy Efficiency of HID Lamps
- Laboratory Accreditation Program
- Test Measurements and Calculations

Test Measurements and Calculations

- 100 hour lamp aging
- Lamp stabilization and re-stabilization if necessary
- Measure electrical and photometric characteristics
  - voltage, current → power
  - Light Output → lumens (integrating sphere)
  - Light Output → color (spectroradiometer)
  - Light Output → distribution (goniophotometer)
- Calculate lamp efficacy (lumens/watts)
- Calculate color values (CCT and CRI)
  - DOE is considering use of color values in establishing equipment classes for energy conservation standards
- Repeat for entire test sample group calculate group statistics.



Test Measurements and Calculations

Issue 13: DOE invites comments and data on the suitability of the proposed measurement and calculation procedures for lamp efficacy, center beam intensity, beam angle, lumen maintenance, and color characteristics (CCT and CRI).

Public Meeting Agenda

1. Statute and Context
2. Proposed HID Lamp Test Procedure
3. Closing Remarks

Closing Remarks

At this time DOE welcomes any closing remarks from interested parties.

Submission of Comments

- **In all correspondence, include all of the following:**
  - Test Procedures for High-Intensity Discharge Lamps
  - Docket Number: EERE-2011-BT-TP-0044
  - Regulatory Identification Number (RIN):1904-AC37

- **Contact Information**

  Email: HIDLamps-2010-TP-0044@ee.doe.gov

  URL:http://www1.eere.energy.gov/buildings/appliance_standards/commercial/high_intensity_discharge_lamps.html

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Comment period closes: Tuesday, February 28, 2012

Back Up SLIDES

Test Method for HID Lamps

Table III.1 ANSI C78.389 HID Lamp Warm-Up and Stabilization Criteria

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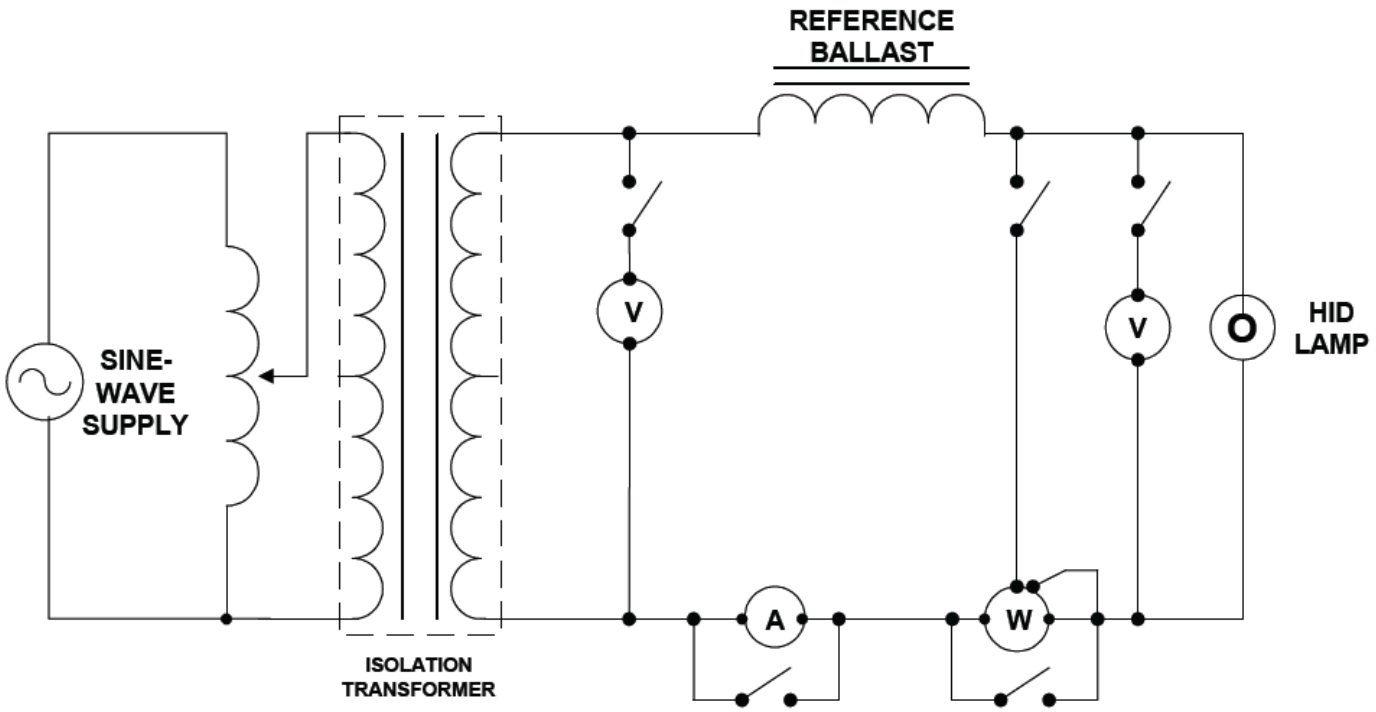
Table III.2 ANSI C78.389 HID Lamp Cool Down and Re-stabilization Requirements

Lamp Type	Cooling Requirement	Re-stabilization Time
MV	None	Not in standard Reconfirm stabilized operations upon transfer/restrike
HPS	Allow to cool for 1 hour minimum before relocating	Not in standard Reconfirm stabilized operations upon transfer/restrike
MH	Cool to below 60 °C if relocating	No relocation no reorientation – 30 minutes Relocation with no reorientation – 30 minutes Reorientation – 6 hours

ANSI C78.389 HID Lamp Test Electrical Circuit Diagram



Warning - Refer to 3.5.4 through 3.5.8 for circuit and equipment grounding procedures

Figure 1
Reference Ballast Circuit for HID Lamp

Requests for Comment in TP NOPR

Issue 1a: DOE invites comment on the proposed new definitions.

Issue 1b: DOE invites comment on the proposed amendments to existing definitions and whether alternative amendments would be more appropriate for HID lamp testing.

Issue 2: DOE requests comment on the proposed ambient test temperature requirements.

Issue 3: DOE requests comment on the proposal to adopt for HID lamps the same air speed requirements as DOE required for the MH Lamp Ballast Test Procedure (2010).

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Issue 7: DOE invites comments and data on the precision and applicability of the proposed sampling method.

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Issue 11: DOE invites comments on the proposed setup and measurement standard selection for directional lamps based on ANSI C78.379.

DOE also invites comments on the various methods for calculating beam angle.

Issue 12: DOE requests comment on the proposal to require NVLAP-accredited (or equivalent) laboratories for testing similar to as DOE required in the GSFL/IRL/GSIL test procedure (issued Dec 2011).

Issue 13: DOE invites comments and data on the suitability of the proposed* measurement and calculation procedures for lamp efficacy, center beam intensity, beam angle, lumen maintenance, and color characteristics (CCT and CRI).

*ANSI C78.379, annex A; CIE 15 and 13.3; IESNA LM-47; and LM-51.